REMARKS

Claims 1-40 are pending. Claims 39-40 have been withdrawn pursuant to a restriction requirement, which Applicants have traversed. Claim 31 has been amended to correct a minor typographical error. No new matter has been added. Claims 1-38 have been examined on their merits.

Claims 1-38 have been rejected as follows:

a) Claims 1-8, 25, 28-36 and 38 have been rejected under 35 U.S.C. §§ 102(a) or 103 (a) over Zhou, et. al "Production of silicon carbide whiskers from carbon nanoclusters," Chemical Physics Letters 222 (1994) 233-238 (hereinafter, "Zhou").

b) Claims 1-38 have been rejected under 35 U.S.C. § 103(a) over Zhou taken with U.S. Patent Nos. 4,915,924 ("Nadkarni") and 4,663,230 ("Tennent").

c) Claims 1-8, 25-36 and 38 have been rejected under 35 U.S.C. §§ 102(b) or 103(a) over U.S. Patent No. 3,246,950 ("Gruber").

For the reasons set forth below, Applicants respectfully traverse each of these rejections and submit that claims 1-38 are patentable and in condition for allowance.

The Office Action also rejected claims 10-24 under the judicially created doctrine of obviousness-type double patenting over claims 11-14 and 17-29 of U.S. Patent No. 6,841,508. Applicants respectfully ask the Examiner to hold the double patenting rejection of these claims in abeyance until they are otherwise indicated to be allowable. Applicants will then offer to file a terminal disclaimer, if appropriate, to obviate this rejection.

A. Applicants' Claims Are Patentable Over Zhou

In the Office Action, claims 1-8, 25, 28-36 and 38 were rejected under 35 U.S.C. §§ 102(a) or 103(a) over Zhou. Applicants respectfully disagree and submit that these claims are all patentable over Zhou.

Whether under 35 U.S.C. §§ 102 or 103, a *prima facie* case of unpatentability can only be established if each and every element of the claims are taught or suggested in the asserted reference. MPEP §§ 2131; 2142.03. Applicants respectfully submit that Zhou fails to teach each of the elements of claims 1-8, 25, 28-36 and 38.

Specifically, Zhou only teaches or suggests silicon carbide whiskers having diameters which are far larger than Applicants' claimed carbide nanofibrils. Zhou's silicon carbide whiskers have diameters between 200-400 nm, which is far larger than the diameter of the carbide nanofibrils recited in Applicants' claims (*i.e.*, less than about 100 nm). As the Office Action noted, the starting material which Zhou uses include carbon nanotubes having diameters between 20-40 nm. (Zhou, p. 234, 2nd column). However, after these starting carbon nanotubes are treated with Zhou's process, the resulting silicon carbon whiskers have diameters which are at least one order of magnitude longer and wider (*i.e.*, diameter increases to 200-400 nm). (Zhou, p. 235, 2nd column). As such, Zhou fails to teach or suggest Applicants' claimed silicon carbide nanofibril diameter limitation and withdrawal of these rejections is respectfully requested.

B. Applicants' Claims Are Non-Obvious Over Zhou Taken With Nadkarni And Tennent

Claims 1-38 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Zhou taken with Nadkarni and Tennent. Applicants respectfully traverse the rejection.

To establish a *prima facie* case of obviousness, three basic criteria must be met: 1) there must be some suggestion or motivation to modify the reference as asserted; 2) there must be a reasonable expectation of success and 3) the combined references must teach or suggest all of the claimed limitation. MPEP § 2143.01. Because none of these criteria have been met, Applicants respectfully submit that the claims 1-38 are patentable over the asserted combination of references.

Zhou teaches a method of producing silicon carbide whiskers in which a carbon nanotube disc is placed above solid SiO in a single reaction zone. The solid SiO is evaporated and the SiO vapor is reacted with the carbon nanotube disc at 1700°C. (p. 234). The resulting silicon carbide whiskers are formed mainly on the surface of the carbon nanotube disc (very few in the middle of the sample) and have diameters which are at least one order of magnitude (*i.e.*, 200-400 nm) greater than the diameter of the starting carbon nanotubes (*i.e.*, 20-40 nm). (pp. 235-236). In other words, Zhou's process results in a substantial increase in size of the starting material.

Zhou also teaches that high temperatures such as 1700°C is both thermodynamically favorable and an important reason why the reaction of carbon nanoclusters without the use of any whisker forming catalysts was able to proceed. (pp. 235-236; *e.g.*, "The conventional reaction of carbon with silicon monoxide will not produce silicon carbide in the form of whiskers without catalysts or other nucleation seeds. However, the reaction of the carbon nanoclusters with silicon monoxide at the high temperature will result in the silicon carbide whiskers without any catalyst involved...") As such, high temperature and the omission of catalysts are both important aspects of Zhou's process.

On the other hand, Nadkarni teaches a process of producing silicon carbide whiskers and other materials using two reaction zones. A first reaction zone contains microfine particles of silicon dioxide uniformly mixed with carbon or a carbon precursor at a ratio of at least 5:1.

(*E.g.*, col. 1, lines 61-69; col. 3, lines 11-39). A second reaction zone contains a porous mass of an infusible carbon precursor or active carbon as well as a continuous fresh supply of whisker forming catalysts. (*E.g.*, col. 2, lines 1-13; col. 3, lines 40 – col. 4, line 21; "A second essential feature of the present invention is the making of a fresh supply of a whisker-forming catalyst continuously available in the second reaction zone...") Thus, Nadkarni's process requires two reaction zones and requires the use of a supply of whisker forming catalyst.

As a result of the presence of the whisker forming catalyst, the reaction temperature for Nadkarni's process is under 1700°C. (Col. 7, lines 41-44).

Furthermore, Nadkarni specifically teaches to use carbon fibers, spheres or particles. Col. 5, line 67 – col. 6, line 1. No mention is disclosed anywhere of using carbon nanotubes. In fact, Nadkarni teaches away from using carbon nanotubes and teaches instead to use carbon fibers. (Col. 6, lines 9-12, "Carbon derived from stabilized PAN is particularly preferred, especially when in the form of fibres."; col. 6, lines 63-66, "Preferably, the carbon precursor is a felt of stabilized PAN fibres, or a product produced form a jumble of staple PAN fibres or hollow spheres produced from PAN...").

Nadkarni further teaches that its process results in a significant decrease in the size of its starting materials. Specifically, Nadkarni's process starts with carbon fibers having diameters between 10,000 to 15,000 nm and results in silicon carbide whiskers having diameters between 500 to 1,000 nm. (Col. 7, line 67 – col. 8, line 3, "However, as there is a significant difference in size between the unreacted carbon (usually in the form of fibres 10-15 μ in diameter; 1000 μ long) and the SiC whiskers (0.5 - 1μ diameter; up to 200 μ long)..."). Thus, Nadkarni's process utilizes extremely large carbon fibers and results in a significant reduction of size in the carbide whisker product.

Unlike Zhou or Nadkarni, both of which are directed to very different process for forming carbide whiskers, Tennent teaches carbon nanotubes and process for forming them.

1A. There Is No Motivation Or Suggestion To Combine Zhou and Nadkarni

Zhou's process is directed to a single reaction zone, to temperatures 1700°C or higher, is whisker-catalyst free, uses carbon nanotubes, and results in carbide whiskers which are far larger than the original starting carbon materials.

On the other hand, Nadkarni's process requires two reaction zones, temperatures less than 1700°C, requires whisker forming catalysts, uses carbon fibers which have far larger diameters (i.e., 10,000 nm vs. 40 nm) and far different reactivities and characteristics from carbon nanotubes, and results in carbide whiskers which are far smaller than the original starting carbon materials.

As such, the process, materials, conditions, and results between these two references are completely different. Thus, there is no motivation or suggestion to even combine Zhou and Nadkarni without the use of impermissible and selective hindsight.

1B. There Is Further No Motivation Or Suggestion To Make The Asserted Modification

In addition to the lack of motivation or suggestion to combine Zhou and Nadkarni, there is also no motivation or suggestion to make the particular modification asserted in the Office Action. Specifically, there is no motivation or suggestion for one skilled in the art to modify the process of Zhou by using the temperature of Nadkarni since Zhou specifically teaches that high temperature (*i.e.*, 1700°C) is required in order for the reaction to proceed without the use of whisker forming catalysts. (Zhou, pp. 235-236).

Furthermore, the proposed modification would impermissibly change the principle of operation of Zhou's process because it would require at least that a whisker forming catalyst be further introduced to the reaction. MPEP 2143.01.

As such, with no proper motivation or suggestion to combine, the asserted combination is improper and withdrawal of this rejection is respectfully requested.

2. There Is No Reasonable Expectation Of Success

Additionally, there is no reasonable expectation of success that the proposed modification would have worked. Specifically, as discussed in the preceding section, Zhou specifically teaches that high temperature (*i.e.*, 1700°C) is required in order for the reaction to proceed without the use of catalysts. (Zhou, pp. 235-236). Thus, there is no reasonable expectation that lowering the temperature of Zhou's reaction to that of Nadkarni's range would work, especially since Nadkarni's process further requires different starting material, two reaction zones and a continuous supply of whisker forming catalyst.

As such, with no reasonable expectation of success, withdrawal of this rejection is respectfully requested.

3. The Asserted Combination Fail To Teach All Of The Claimed Elements

All of the pending claims 1-38 recite a limitation that the silicon carbon nanofibrils have a diameter less than about 100 nm.

As set forth in the preceding sections, none of the asserted references alone or in combination teaches silicon carbon nanofibrils having a diameter less than about 100 nm. Zhou's silicon carbon whiskers have diameters ranging from 200 nm to 400 nm. (Zhou, pp. 235-236). Nadkarni's carbide whiskers have diameters ranging 500 to 1,000 nm. (Nadkarni, col. 7, line 67 – col. 8, line 3). Tennent does not teach carbide nanofibrils.

As such, the asserted combination fail to teach all of the claimed elements and withdrawal of this rejection is respectfully requested.

D. The Present Claims Are Novel and Non-Obvious Over Gruber

Claims 1-8, 25-36 and 38 were rejected under 35 U.S.C. §§ 102(b) or 103(a) over Gruber. Applicants respectfully traverse.

Gruber teaches and discloses a fibrous form of silicon carbide and a method for its preparation via precipitation from a reaction of gaseous silicon monoxide with gaseous carbon monoxide. (*e.g.*, col. 1, line 68- col. 2, line 1, col. 2, lines 17-24)(*e.g.*, col. 1, lines 11-14 and lines 38-40). Gruber also teaches that its precipitated carbide products are fibers having diameters from 5 nm to 1,000,000 nm (*e.g.*, col. 2, lines 4-5) and lengths from 25 nm to 25,000 meters (*e.g.*, col. 2, lines 7-8).

1. Gruber Is Not An Enabling Reference

For anticipation to hold, a prior art must be enabling. *In re Donohue*, 226, U.S.P.Q. 619, 621 (Fed.Cir. 1985); *In re Borst*, 45 U.S.P.Q. 554, 557 (C.C.P.A. 1965). Furthermore, a compound is not obvious if there is no known obvious way to prepare it. *In re Hoeksema*, 158 U.S.P.Q. 596 (CCPA 1968); *In re Riden*, 138 U.S.P.Q. 112 (CCPA 1963); *Ex parte Argoudelis*, 157 U.S.P.Q. 437 (POBA 1967).

As an initial matter, Applicants respectfully submit that Gruber is not an enabling reference which can be relied on or asserted against Applicants' claims. Specifically, one of ordinary skill in the art would recognize that Gruber could not have possibly obtained SiC fibers with a diameter range to the size of a small child (*i.e.*, 1,000,000,000 nm = 1 m = 3.2 feet) and length of 25,000 meters (*i.e.*, approximately 15 miles long). More specifically, one of ordinary skill in the art would further realize that it is not possible to precipitate from Gruber's gaseous reaction such an enormously large product. Even more specifically, one of ordinary skill in the

art would have no doubt that Gruber is not an enabling reference since Gruber claims in Example 4 to have precipitated such an enormous product from a rather small Vycor tube reactor (Col. 5, lines 46-68).

As such, Gruber is not an enabling reference which can be relied on or asserted for prior art purposes and withdrawal of this rejection is respectfully requested.

2. Gruber Does Not Teach Or Suggest Applicants' Recited Limitation

Gruber teaches that its carbide products are fibers having diameters from 5 nm to 1,000,000 nm. (*e.g.*, col. 2, lines 4-5). In other words, Gruber's process purportedly yield carbon fibers having diameters as small as 5 nm or as large as 1 meter (*i.e*, 3.2 feet). Thus, Gruber does not disclose silicon carbide nanofibrils predominantly having diameters less than about 100 nanometers as recited in Applicants' claims and therefore does not anticipate or render obvious the presently claimed invention.

The Examples in Gruber confirm that Gruber does not teach silicon carbide nanofibrils predominantly having diameters less than about 100 nanometers as recited in Applicants' claims. Example 1 ("The individual fibers were approximately...about 6,000 angstroms [600 nm] in diameter"); Examples 4 ("The product obtained was...silicon carbide...with a fiber diameter ranging from 50 angstroms [5 nm] to 10,000,000,000 angstroms [1,000,000,000 nm]"); Example 9 ("The individual fibers were...about 6,000 angstroms in diameter [600 nm]"); Example 11 ("The silicon carbide fibers...were found to have...diameter of about 5,000 angstroms [500 nm]"). Thus, as shown in his working examples, Gruber's process will yield silicon carbide products predominantly having diameters greater than 100 nm.

As such, withdrawal of this rejection is respectfully requested.

3. Gruber Is Also Not Enabling For Applicant's Recited Limitation

Applicants also respectfully submit that the teachings of Gruber fail to specifically enable one of ordinary skill in the art to make carbide nanofibrils predominantly having diameters less than about 100 nm.

As explained above, Gruber discloses silicon carbide fibers having a large diameter range from 5 nm to 1,000,000,000 nm. If Gruber did somehow make fibers with such a wide range, then at the very least, this further confirms that Gruber cannot teach making silicon carbide nanofibrils predominantly having diameters less than about 100 nm. In fact, no where does Gruber teach how to make silicon carbide nanofibril predominantly having diameters less than about 100 nm. The Examples confirm that Gruber has never made, and is unable to make, silicon carbide nanofibrils predominantly having diameters less than about 100 nm. *Supra*, Section D.2. As such, one skilled in the art would not know from reading Gruber how to make carbide nanofibrils predominantly having diameters less than about 100 nm.

Moreover, Applicants' specification confirm that "although some attempts have been made to synthesize silicon carbide fibers and nanofibers, the prior art efforts have not been successful in synthesizing high and consistent quality silicon carbide, or other carbide, nanofibrils predominately in diameters substantially smaller than 100 nm" (specification, page 5, lines 7-11; see also page 4). Therefore, Applicants urge that Gruber, either alone or in combination with the secondary references, does not enable one of ordinary skill in the art to practice the claimed invention. Withdrawal of this rejection is thus requested.

4. Gruber Teaches That His Purported Products Are Unique

With respect to "product-by-process" claims 25-37, Applicants further urge that the rejection of these claims over Gruber is also improper for the additional reason that the Office Action failed to establish that the claimed product appears to be same or similar to that of the

product made by Gruber's different process. MPEP 2113. In light of Gruber's own teachings, there is no rationale for concluding that Gruber's carbide products are the same as Applicants' claimed carbide nanofibrils. Specifically, Gruber teaches that conventional methods of forming carbide in fibrous forms using solid to solid reaction results in limited purity. (*e.g.*, col. 1, lines 48-66). As a result, Gruber teaches that he has found "an entirely new form of silicon carbide" which is formed only by reaction of a gaseous silicon monoxide with gaseous carbon monoxide. (*e.g.*, col. 1, line 68- col. 2, line 1, col. 2, lines 17-24). Thus, Gruber himself confirms that carbide fibers formed from different phases of starting materials are indeed different from each other (*i.e.*, carbide formed form solid-solid reactions are different from those formed in gas-gas reactions).

As such, one skilled in the art (and even Gruber himself) would conclude that Gruber's carbide products, which are precipitated from a gas-gas reaction, are different from Applicants' carbide nanofibrils, which are formed from a gaseous-solid reaction in which the claimed carbide nanofibrils are grown topotactically from the initial solid phase carbon nanotubes. There is no reasonable basis for asserting that carbide fibers precipitated from two gases as in Gruber would or can be the same as the carbide nanofibrils topotactically grown from solid phase carbon nanotubes. In fact, the opposite is true. For example, Gruber's carbide products can grow to diameters greater than 1 m, and obviously cannot adopt a morphology similar to the original gaseous carbon monoxide. On the other hand, Applicants' carbide nanofibrils will not grow to 1 m in diameter and will inherit certain macroscopic morphological features of the starting carbon nanotubes. Thus, it is clear that Gruber's carbide products are not the same or similar to Applicants' claimed carbide nanofibrils.

Thus, reconsideration and withdrawal of this rejection is respectfully requested.

In view of the foregoing, Applicants respectfully submit that claims 1-38 are in condition for allowance and such action is earnestly solicited. If there are any issues preventing the issuance of a Notice of Allowance, the Examiner is respectfully asked to contact Applicants' undersigned attorney.

No fees are believed due in connection with the filing of this Amendment. However, if any additional fees are necessary, the Director is hereby authorized to charge such fees to Deposit Account No. 50-0540.

Respectfully submitted,
KRAMER LEVIN NAFTALIS & FRANKEL LLP
Attorneys for Applicants

Date: May 18, 2005 By: _____

Barry Evans, Reg. No. 22,802
Albert B. Chen, Reg. No. 48,265
1177 Avenue of the Americas
New York, New York 10036
Phone (212) 715-9100
Fax (212) 715-8000